

Route 501/Route 221 (Lakeside Drive) Sub-Area Traffic Study Lynchburg, Virginia



Performed for: City of Lynchburg, Virginia
By: **PARSONS**
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Route 501/Route 221 (Lakeside Drive) Sub-Area Traffic Study

The Route 501/Route 221 (Lakeside Drive) Sub-Area Traffic Study was performed to assess the traffic impacts of proposed developments in the vicinity of the Route 501 Lynchburg Expressway and Route 221 Lakeside Drive. The intersection of these two roads and the immediate vicinity currently present some of the highest levels of congestion in the City of Lynchburg; resulting in the consideration of constructing an interchange at this location. Alternatives to the interchange configuration currently being considered were also developed and tested as part of this study. The goals for the study were two-fold:

1. Develop and test transportation improvements that will serve existing and future traffic, including traffic generated by several regionally significant retail developments, and
2. Seek alternatives to the designs currently under consideration for this Route 501/221 intersection that would be less costly, create fewer impacts, and minimize potential right-of-way impacts on adjacent parcels.

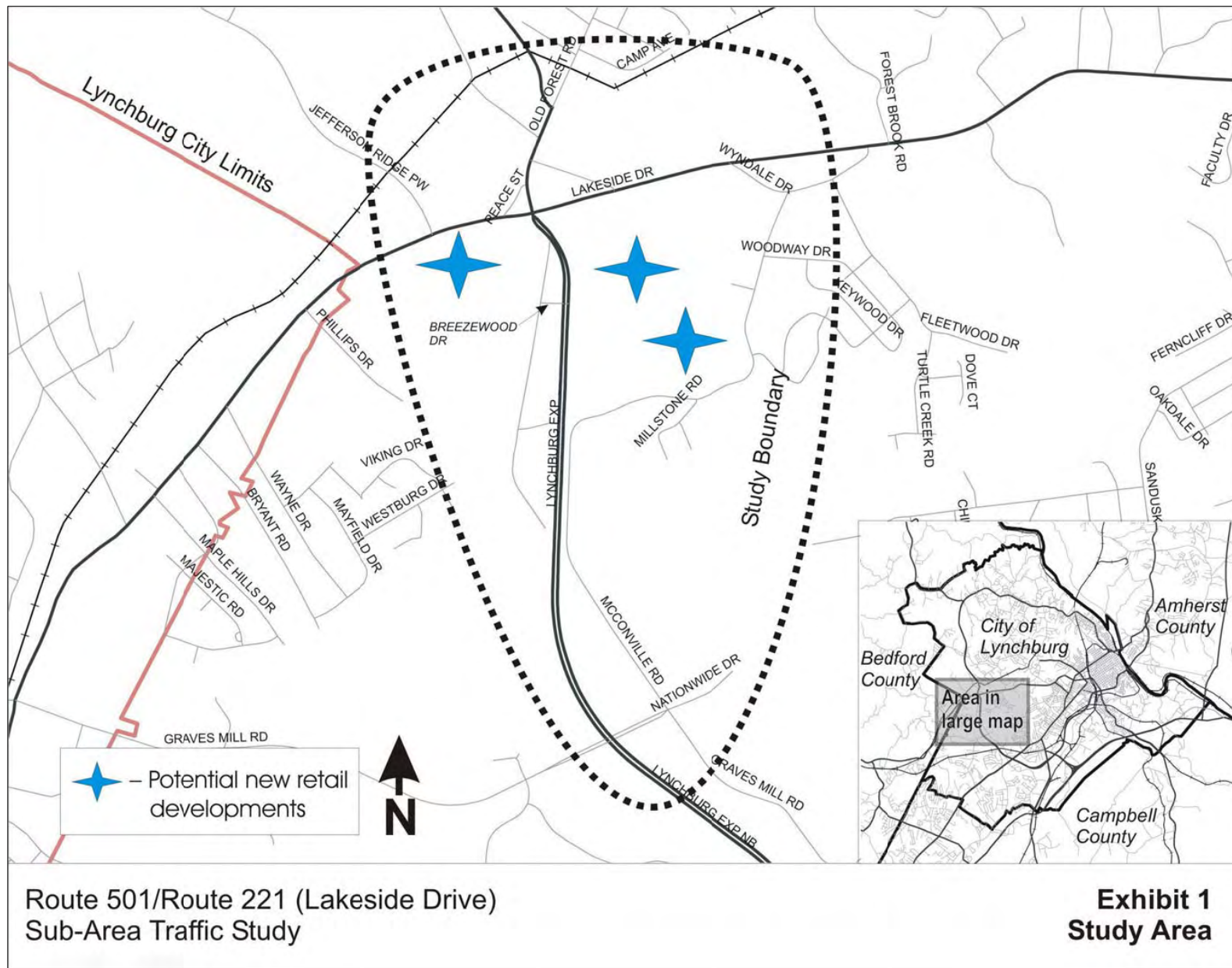
The area included in the study is shown in Exhibit 1. Exhibit 1 also highlights the location of potential new retail areas; the traffic effects of these areas were assessed as part of the study.

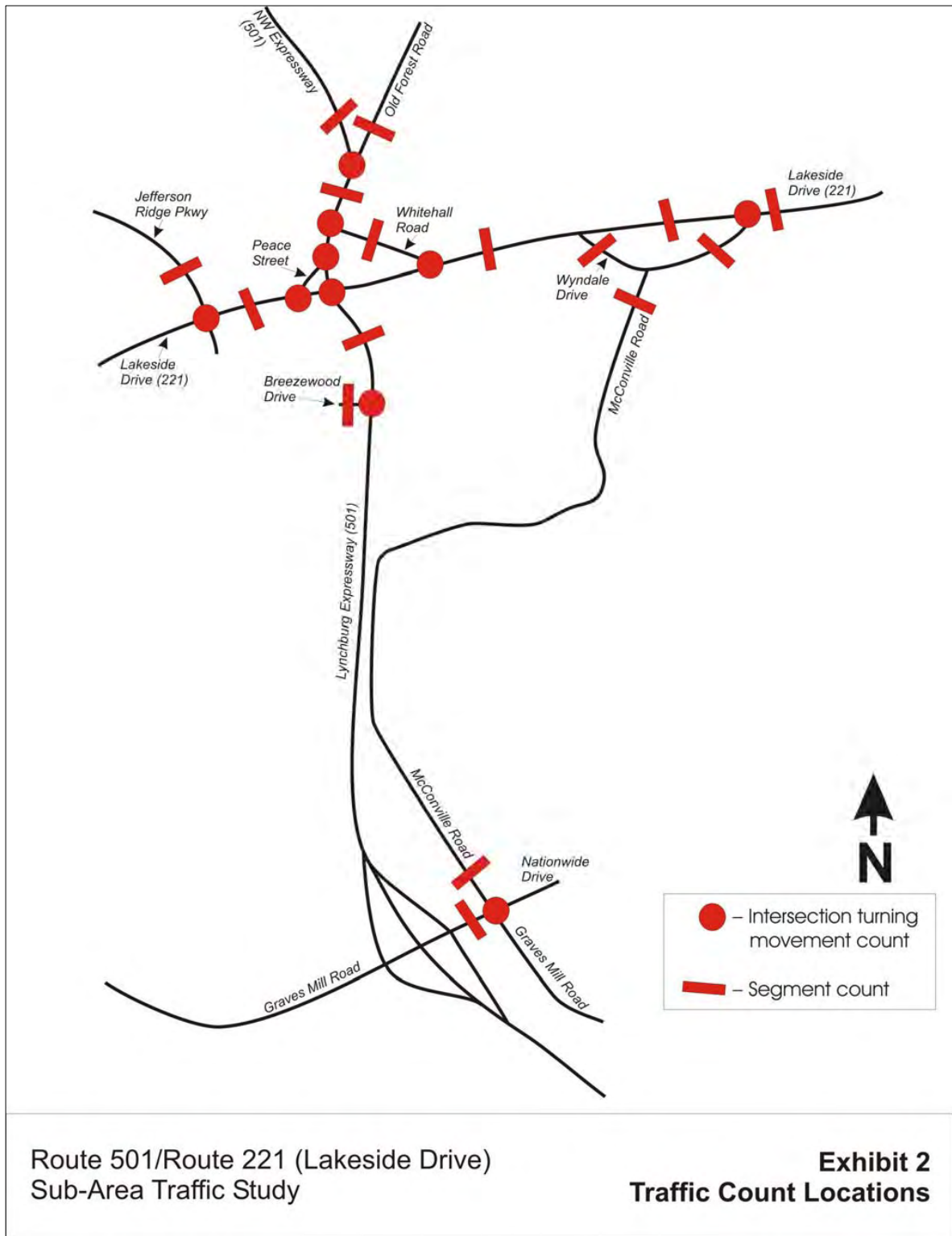
1. Study Methodology

The study included the following:

1. collection and assimilation of existing traffic counts
2. analysis of existing traffic operations using standardized intersection capacity analysis techniques
3. assessment of proposed land development in the study area, including trip generation and trip distribution for traffic that would be created by this proposed development
4. assessment of traffic operations with the addition of traffic generated by proposed traffic
5. development of recommendations to address the traffic operations needs in the area with the inclusion of new development traffic.

Data used for the study included an extensive set of traffic counts performed by the Virginia Department of Transportation (VDOT) as part of ongoing efforts to re-assess proposed improvements to Lakeside Drive and Kemper Street extending from Route 501 to the Route 29 Expressway (known locally as the Mid-Town Connector). Traffic counts to supplement the VDOT counts were also performed on McConville Road, Wyndale Drive, and Graves Mill Road. Count locations are shown in Exhibit 2. In addition to these counts, data for the intersections of 501 Expressway ramp termini and Old Graves Mill Road was derived from previous studies and factored based on the segment count performed on Graves Mill Road between the 501 Expressway and McConville Road.





All roadway capacity analyses were performed using the methodology of the Highway Capacity Manual and the SYNCHRO Version 6 software. Trip generation was performed using rates from the ITE Trip Generation Manual, 7th Edition. Additional details on methodologies are included throughout this report.

2. Development of Base and Forecast Traffic Volumes

Count data for all of the locations shown in Exhibit 2 were summarized and peak hour volumes were developed for weekday a.m., mid-day, and p.m. peak hours. Because of the variability of traffic from day-to-day, traffic volumes were “smoothed” – this process averages traffic count data across locations so that traffic volumes between adjacent intersections are consistent. Base year traffic data for intersections in the study area is shown in Exhibits 5, 6, and 7 for each of the peak periods.

To account for proposed development within the study area, estimates of the amount of traffic that the development would generate was calculated using the methodologies of the ITE Trip Generation Manual, 7th Edition. Three shopping centers were assumed to be constructed within the study area by the year 2010. The Site 1 shopping center was assumed to be the largest and is located in the southeast quadrant of the Route 501/Route 221 intersection with primary access onto Lakeside Drive west of Route 501. This shopping center would also include a new roadway between McConville Road and Lakeside Drive (this roadway is shown in all of the traffic volume exhibits). The Site 1 Shopping Center is estimated to have 668,000 square feet of general shopping center retail space.

Another shopping center is being considered just south of the Lakeside Shopping Center. The Site 2 Shopping Center is anticipated to have approximately 400,000 square feet of general shopping center retail space. The third shopping center is located south of Lakeside Drive and east of its intersection with Jefferson Ridge Parkway. The Site 3 Shopping Center is anticipated to have 400,000 square feet of general shopping center retail space, of which 200,000 was assumed to be open by 2010. Exhibit 3 shows the estimated traffic that would be generated by these three shopping centers.

Several items should be noted in interpreting Exhibit 3. The first is that the same trip generation rates were used for all three shopping centers. All three shopping centers are anticipated to include a mix of uses, including restaurants on out-parcels, with specific details still being refined. A consistent, somewhat generic trip rate was, therefore, used. In addition, trip rates are generally similar for shopping center retail uses between mid-day and p.m. peak hours, so a single rate was used for both periods. For all three sites, a trip rate of 1.03 trips per 1,000 square feet was used for the a.m. peak hour, while a trip rate of 3.74 trips per 1,000 square feet was used for both the mid-day and p.m. peak hours. In the a.m. peak, approximately 60 percent of the generated trips were assumed to be entering the shopping centers (with the remainder exiting), while in the mid-day and p.m. peak periods the number entering and exiting is approximately even.

Exhibit 3
Trip Generation for Proposed New Shopping Centers

Description	Estimated Square Footage	AM Peak Hour			MD/PM Peak Hour		
		Total	In	Out	Total	In	Out
Site 1 Shopping Center	668,150	688	420	268	2499	1199	1300
Pass-By Trips		-138	-84	-54	-500	-240	-260
Site 1 Net Trips		551	336	214	1999	959	1040
Site 2 Shopping Center	400,000	412	251	161	1496	718	778
Pass-By Trips		-82	-50	-32	-299	-144	-156
Site 2 Net Trips		330	201	129	1197	574	622
Site 3 Shopping Center	200,000	206	126	80	748	359	389
Pass-By Trips		-41	-25	-16	-150	-72	-78
Site 3 Net Trips		165	101	64	598	287	311
Total Estimated Trips	1,268,150	1306	797	509	4743	2276	2467
Total Pass-By Trips		-261	-159	-102	-949	-455	-493
Net Estimated New Trips		1045	638	407	3794	1821	1974

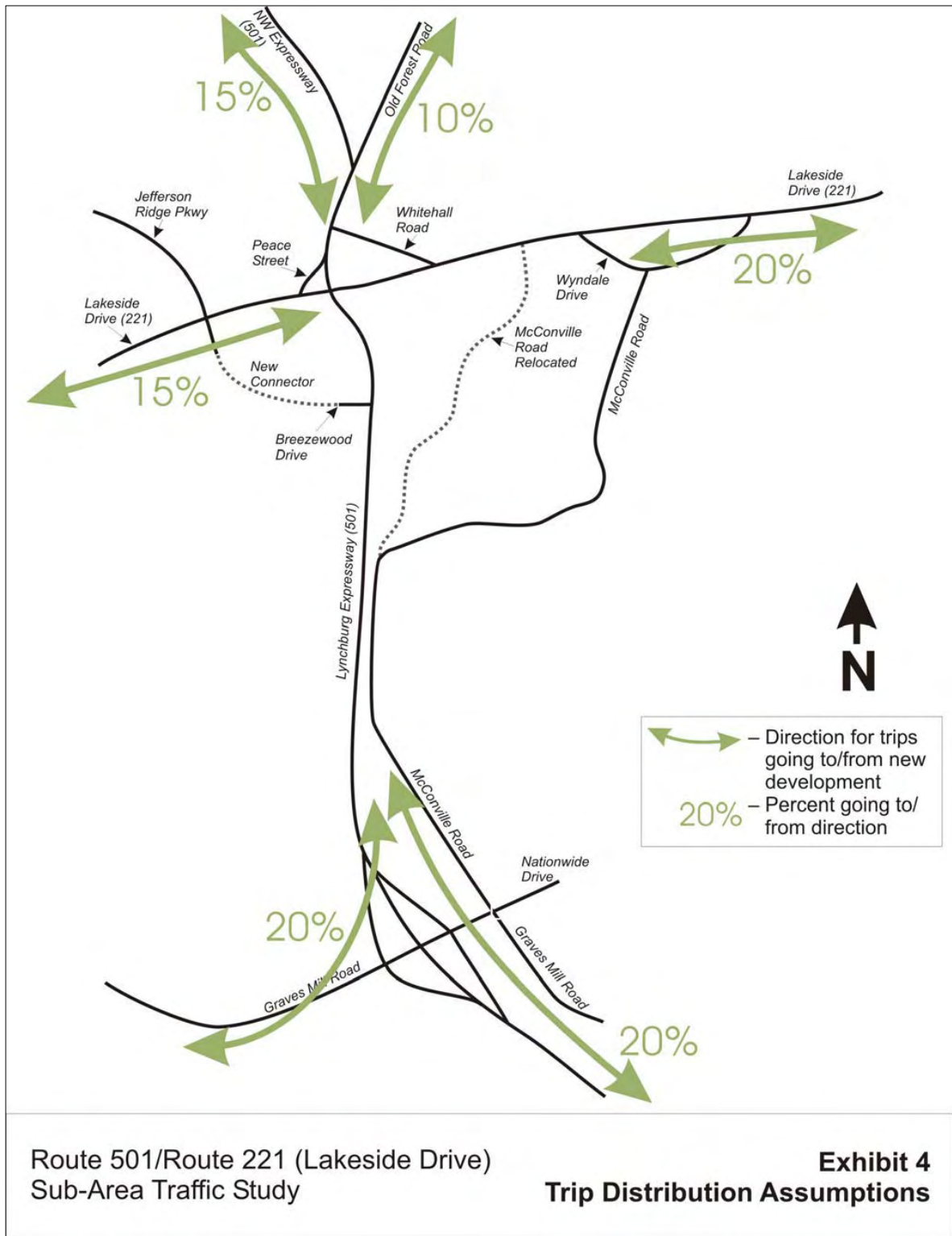
Note: Trip generation rates of 1.03 trips per 1,000 square feet in the a.m. peak, and 3.74 per 1,000 square feet in the mid-day and p.m. peaks are based on the ITE Trip Generation Manual, 7th Edition.

A rate of 20 percent was assumed for pass-by trips. Pass-by trips represent those motorists who are already on the study area roadway network and would not, therefore, be new trips to the study area. These trips can be characterized as motorists who are driving home from work but stop to get groceries. A pass-by rate of 20 percent is typical for shopping centers such as the ones being considered for the study area. While pass-by trips are not shown as new trips to the study area, they are included at the entry intersections to the shopping centers.

New shopping center trips were distributed based on estimated travel patterns as determined in coordination with City and VDOT staff. The general assumptions for the origins (and destinations) of trips going to/from the new shopping centers are shown in Exhibit 4. These distribution assumptions were refined for purposes of assigning the trips to individual study area intersections.

Final estimates for year 2010 traffic volumes incorporated growth (often termed background growth) in the 2005 traffic. To account for the five years between 2005 and 2010, all traffic on the network was grown by 8 percent. This represents an annual growth of 1.6 percent (non-compounded).

It was also assumed that two major roadway improvements in the study area would be in place by 2010. The first of these is the Breezewood Drive Connector, which will connect Breezewood Drive to Lakeside Drive. This new connector road, included in the Virginia Department of Transportation's Six-Year Improvement Program, would improve safety at the Breezewood Drive intersection with the Route 501 Expressway by re-configuring it for right-in/right-out operations only. Traffic that currently turns either left on to Breezewood Drive from the Route 501 Expressway (northbound lefts) or left out of



Breezewood Drive (eastbound lefts) would access the roadway network via Lakeside Drive. The estimated 2010 traffic accounts for the diversion of these left turns.

The second improvement, anticipated to be developed as part of the Site 1 Shopping Center, is the relocation of McConville Road. The relocated roadway would extend north from existing McConville Road approximately 0.8 miles north of Graves Mill Road, extend in a northeasterly direction, and tie into Lakeside Drive at a new intersection approximately 0.4 miles east of the existing Route 501/ Lakeside Drive intersection.

Based on the calculation of new trips shown in Exhibit 3 and the distribution percentages shown in Exhibit 4, new trips on the study roadway network were estimated. As indicated above, these new trips were added to estimates of year 2010 background traffic to estimate total year 2010 traffic.

Traffic volumes for a horizon year of 2030 were also calculated. These were estimated by increasing the 2005 traffic volumes by an additional 20 percent (resulting in a total background traffic growth from 2005 to 2030 of 28 percent), accounting for all three shopping centers and full build-out of the Site 3 Shopping Center. As indicated previously, it was assumed, for 2010 conditions, that the Sites 1 and 2 Shopping Centers would be built out, and that the Site 3 Shopping Center would be built at 50 percent. The 2030 forecasts include traffic that would be generated by building the remaining 50 percent of the Site 3 Shopping Center between 2010 and 2030.

Exhibit 5 summarizes the estimated daily traffic volumes by segment for each of the analysis years. Note that the traffic estimates for 2010 and 2030 include new shopping center traffic as described above. Detailed traffic estimates, including turning movement data at all key intersections in the study area, are included in Appendix A.

Exhibit 5
Estimated Daily Traffic

Location			
	2005	2010	2030
Lakeside Drive west of Jefferson Ridge Parkway	28,800	41,400	51,700
Lakeside Drive between Jefferson Ridge Parkway and Route 501	30,300	43,200	53,100
Lakeside Drive between Route 501 and Site 1 Shopping Center entrance	18,300	42,500	47,200
Lakeside Drive between Wyndale Drive West and Wyndale Drive East	15,200	25,000	29,000
Route 501 Northwest Expressway north of Old Forest Road	14,900	23,600	29,500
Old Forest Road north of Route 501 Northwest Expressway	26,000	31,000	34,600
Old Forest Road between Whitehall Road and Route 501 Northwest Expressway	38,700	52,800	62,000
Route 501 Expressway between Breezewood Drive and Lakeside Drive	37,600	44,200	52,900

Exhibit 5
Estimated Daily Traffic

Location			
	2005	2010	2030
Graves Mill Road between Route 501 Expressway and McConville Road	11,300	27,700	30,100
McConville Road north of Graves Mill Road	6,500	21,400	22,700

Note: Traffic volumes for 2010 and 2030 include background traffic growth and new site traffic as described in the report text.

3. Development of Alternatives

Improvements needed to accommodate projected travel demands were identified and tested using Synchro Version 6 software. This traffic engineering software allows for the assessment of traffic operations using the standard level of service ranking. Level of service is a concept used by traffic engineers to grade the operations of roadways, intersections, and interchanges. Similar to a report card, levels of service range from A to F, with A representing excellent traffic flow and F representing breakdown conditions with major delays. For this study, the VDOT standard of level of service C or better was used as the basis for determining if a facility is deficient.

For all locations in the study roadway network, improvements to roadways and intersections to allow for adequate (level of service C or better) operations in 2010 were developed. For most locations and time periods, level of service C or better was also achieved for 2030 conditions.

For purposes of discussion in this report, analysis and recommended improvements are described for groups of analysis locations. Group 1 consists of the intersections of Lakeside Drive at the Route 501 Expressway and Old Forest Road at the Route 501 Northwest Expressway. Group 2 includes all other key intersections within the study area. Improvements to address travel demands through the Group 1 intersections involved the assessment of various interchange configurations. Needed improvements for Group 2 locations generally consist of the addition of turn lanes at key intersection locations.

To address the capacity concerns at the Group 1 locations (covering the junction of Lakeside Drive, Route 501 Expressway, and Old Forest Road), ten alternative improvements were developed and tested. As described earlier, the goal for improvements at this critical roadway junction was to identify improvements that would accommodate travel demands, and minimize both costs and right-of-way impacts. The alternatives were compared with the recommendation of a previous study of the Route 501/Lakeside Drive intersection, which is included as Alternative 10 in this current study. All of the tested improvements for the Lakeside Drive/Route 501/Old Forest Road junction would reduce right-of-way requirements, particularly in the southeast quadrant of the intersection, as compared to Alternative 10. All of the potential improvements are also anticipated to be less costly to construct than Alternative 10.

The alternatives plus the No Build or do-nothing option, are shown in Exhibits 6 through 16. These graphics also show the proposed lane configurations at key locations for both 2010 and 2030 conditions. Each alternative is described briefly below, while a comparison of traffic operations for the alternatives is included in the next section.

Alternative 1 (shown in Exhibit 7) consists of adding turn lanes to the existing intersections at Lakeside Drive at the Route 501 Expressway and Old Forest Road at the Route 501 Northwest Expressway. At Lakeside Drive at the Route 501 Expressway, left turn lanes would be provided for all approaches (currently only the northbound approach has dual lefts). The separate right turn lanes on the eastbound, westbound, and northbound approaches would be retained. At the Old Forest Road/Route 501 Northwest Expressway intersection, the eastbound Expressway approach would be re-configured to provide one lane for free-right turns onto southbound Old Forest Road and the second lane would allow for both left and right turns which would be controlled by the signal. Southbound Old Forest Road would be widened to three lanes to Peace Street providing an acceptance lane for the free-rights from the Expressway. Northbound Old Forest Road would be widened to accommodate dual 300' left turn lanes onto the Northwest Expressway. The Expressway would be widened to accommodate two lanes in the westbound/northbound direction – these two lanes would be narrowed to one just prior to the bridge over the railroad tracks. Accommodating two lanes on the Expressway in the westbound/northbound direction beyond the railroad tracks would require widening the bridge over the railroad tracks.

Similar to Alternative 1, **Alternative 2** (shown in Exhibit 8) would provide similar double left turn lanes for all approaches at the Lakeside Drive/Route 501 Expressway intersection. In order to provide for more ideal geometrics that would be precluded by some of the right-of-way constraints at the existing intersection location, the intersection in Alternative 2 would be shifted to the east. This shift would also provide the following benefits:

1. Better approach geometrics for the section of the Route 501 Expressway south of Lakeside Drive.
2. Ability to provide for free-right turns with acceptance lanes on each leg of the intersection (reducing overall vehicular delays at the intersection).
3. Ability to put the traffic that currently uses Peace Street shortcut from southbound Old Forest Road to westbound Lakeside Drive onto Old Forest Road. Shifting this shortcut traffic from Peace Street onto Old Forest Road is recommended as Peace Street is not designed to accommodate projected traffic loads.

It should be noted that one of the disadvantages of this alternative is that it does sharpen the curve on Old Forest Road between Lakeside Drive and the Route 501 Northwest Expressway.

Alternative 3 (Exhibit 9) is the first of the alternatives to provide for grade-separation. This alternative provides for a minimal footprint as well as the ability to provide for a large number of travel lanes through the interchange area that can then taper quickly once outside of the interchange area. The alternative splits the northbound and southbound

lanes of the Route 501 Expressway and allows for access through a single-point intersection in between the travel lanes. While somewhat unconventional, this alternative accommodates travel demands within a relatively narrow right-of-way and also provides significant benefits in terms of construction since traffic can be maintained on one side while construction occurs on the other and vice-versa. This alternative, as well as Alternatives 5 through 10, also provide for grade-separation at the Old Forest Road/Route 501 Northwest Expressway intersection.

Alternative 4 (Exhibit 10) creates a split intersection which allows each of the two intersections to operate with one less traffic signal phase than a full four-leg intersection. By coordinating these signals, the operations of the two intersections can provide for additional capacity overall. The improvement for this alternative also extends to the location of the current intersection of Old Forest Road and the Route 501 Northwest Expressway. Under this alternative, this intersection would operate as an at-grade signal with additional lanes on the approaches to the intersection. As with Alternatives 1 and 2, the southbound/eastbound approach from the Northwest Expressway would include a free right turn with appropriate acceptance lane on Old Forest Road. The northbound approach to the intersection would include dual through lanes and dual right turn lanes which could be free-flowing. A right turn lane is also recommended for the southbound Old Forest Road approach. Note that the Route 501 Northwest Expressway would have four lanes (two approach and two exit) between Old Forest Road and the railroad bridge, but would narrow to two lanes across the bridge (this alternative does not include widening the railroad bridge).

One of the benefits of this alternative is that it can be constructed as an interim for ultimately implementing the recommendation of Alternative 3; and it provides similar benefits as Alternative 3 in terms of ease of maintaining traffic flow during construction. Note that the improved at-grade intersection at Old Forest Road and the Route 501 Northwest Expressway included in this alternative could also be an option with Alternative 3 (this option is discussed further in Section 4).

Alternative 5 (Exhibit 11) provides for a standard diamond interchange with Old Forest Road functioning as part of the northwest quadrant ramp. The configuration also allows motorists traveling westbound on Lakeside Drive to turn right at the intersection on the east side of the Route 501 overpasses, thereby removing some traffic on Old Forest Road.

Alternative 6 (Exhibit 12) is similar to Alternative 5 with the exception of providing a loop ramp to accommodate the westbound Lakeside Drive to southbound Route 501 Expressway traffic. In Alternative 5, this traffic turned left at-grade at the intersection west of the freeway overpass.

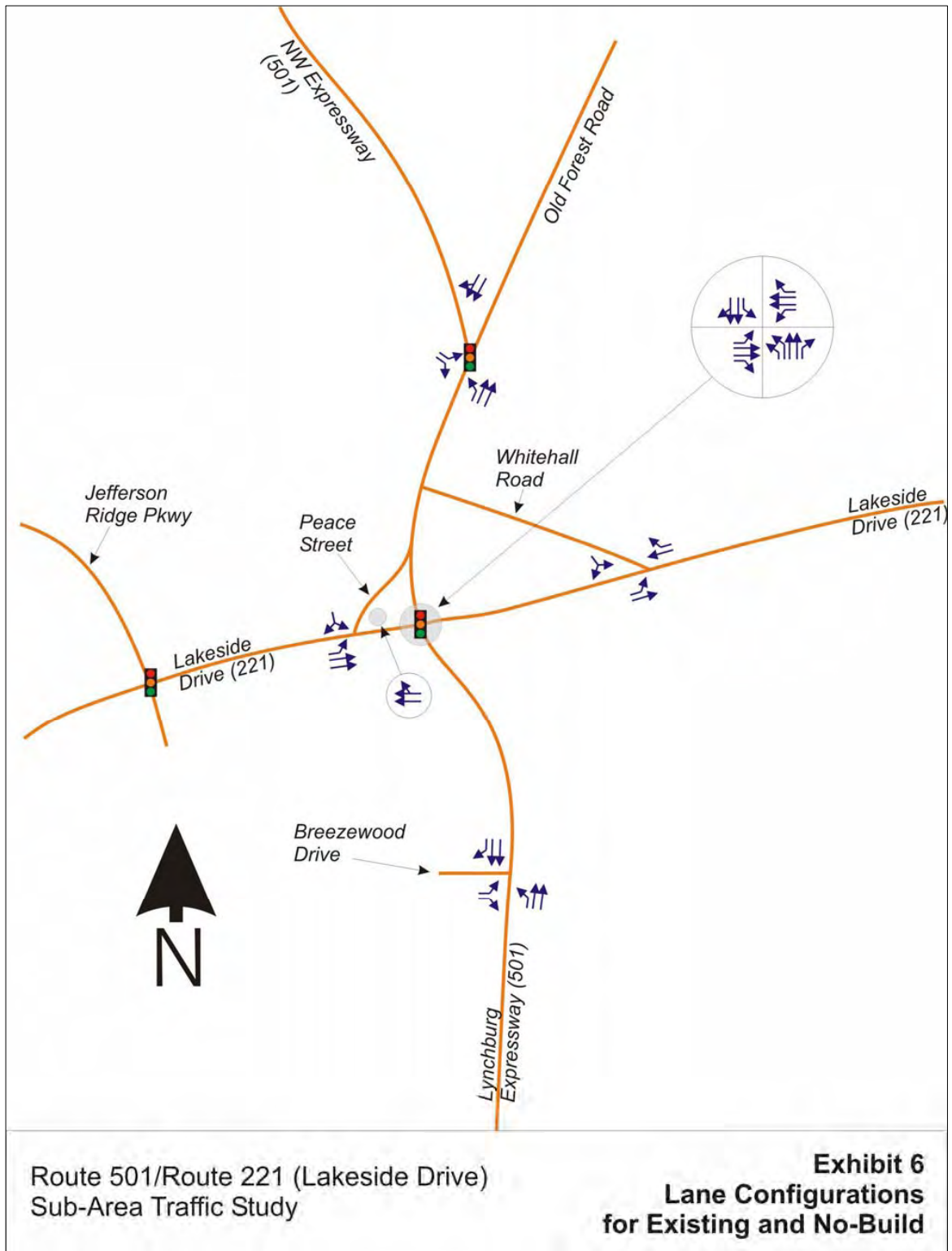
Alternative 7 (Exhibit 13) incorporates the loop ramp of Alternative 6, and also provides additional relief for the intersection west of the freeway overpass (at Old Forest Road) by putting the southbound Route 501 to eastbound Lakeside Drive traffic on a free-flowing loop ramp.

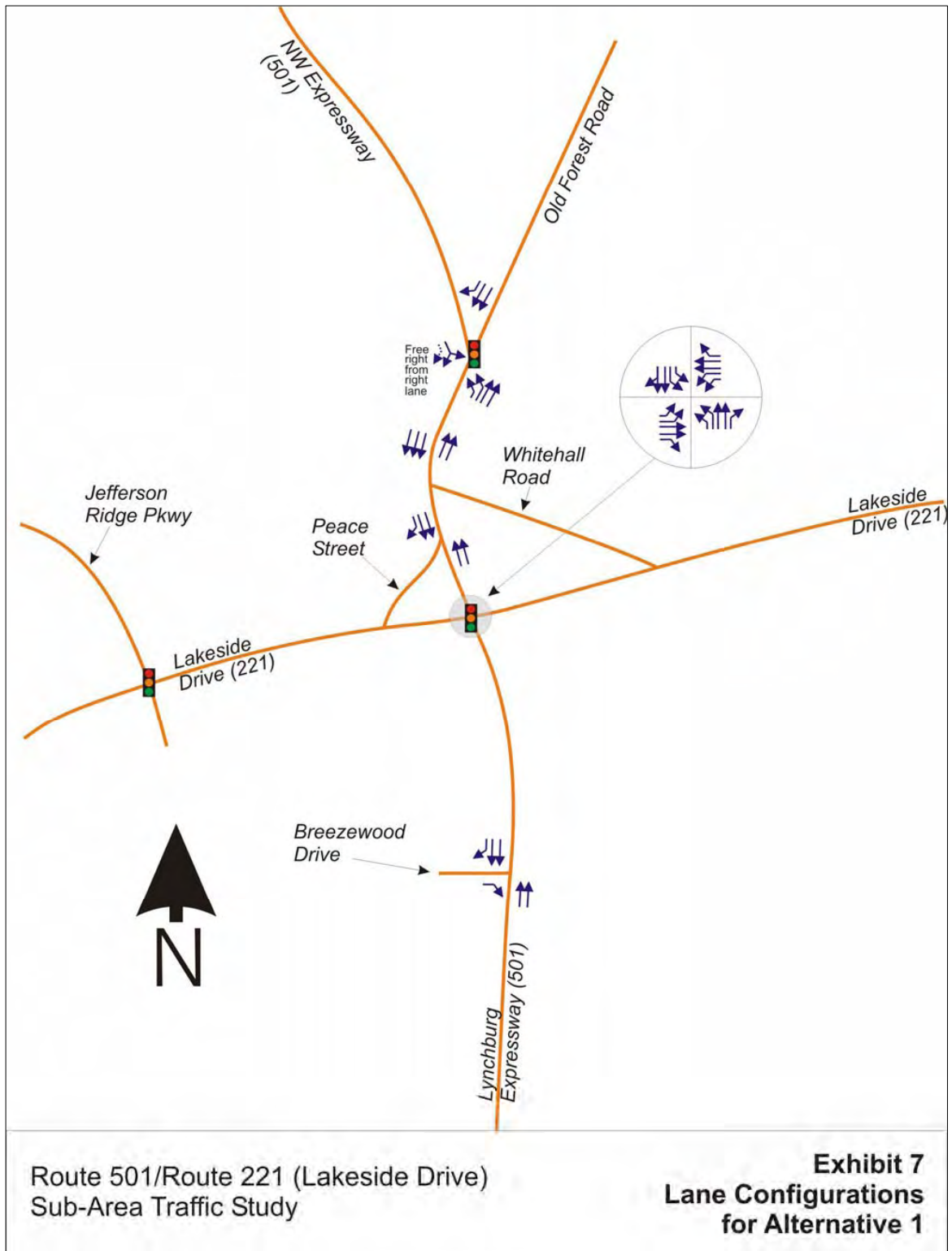
Alternative 8 (Exhibit 14) provides only the loop ramp in the southwest quadrant of the interchange that Alternative 7 does. Together with Alternatives 6 and 7, this alternative allows for the testing of all combinations of loop ramps west of the freeway overpass.

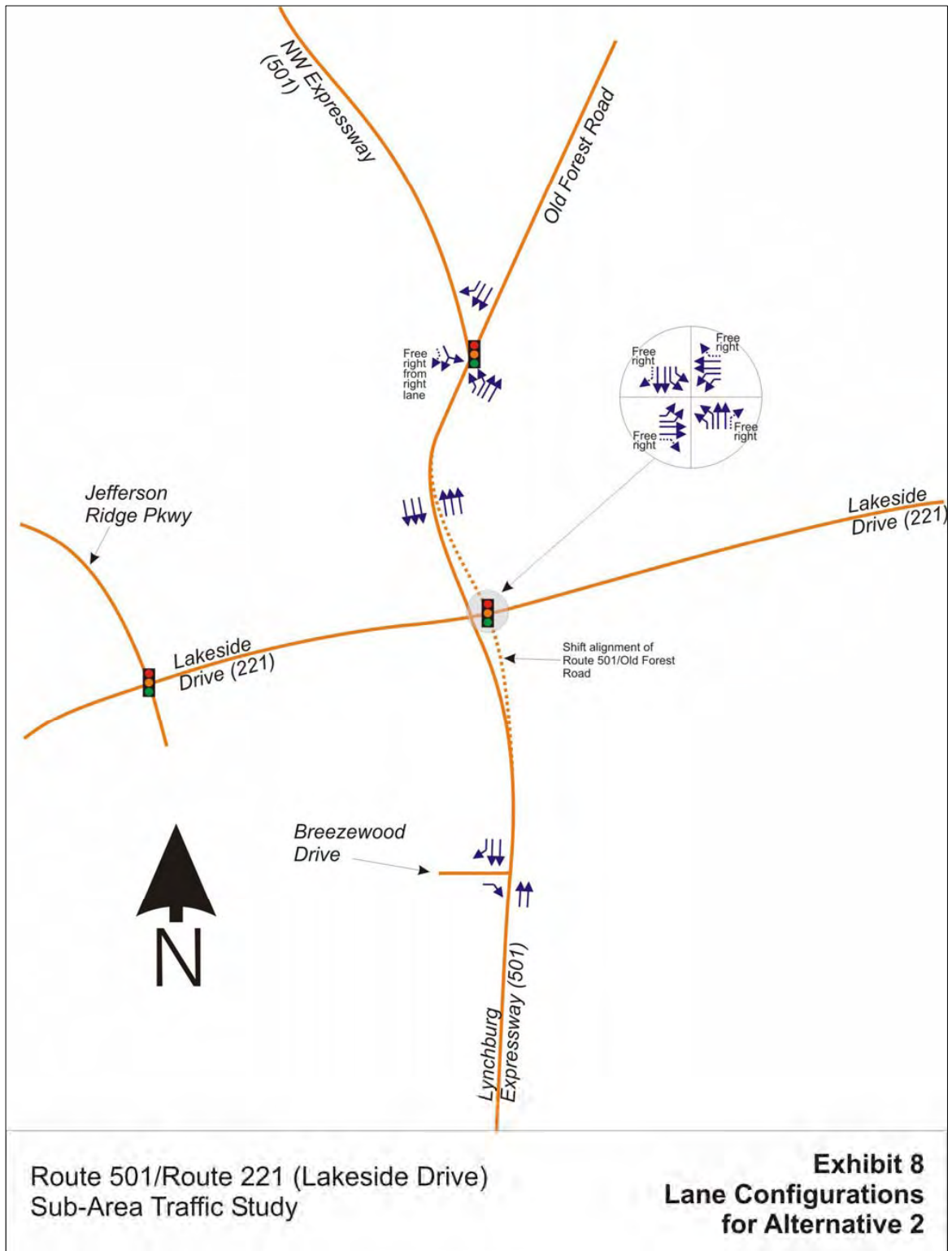
Alternative 9 (Exhibit 15) allows for the removal of a traffic signal on the east side of the freeway overpass through two loop ramps: one is in the northeast quadrant of the Route 501/Lakeside drive interchange, while the other connects northbound Old Forest Road to northbound Route 501. With the loop ramp at Old Forest Road, traffic going from eastbound Lakeside Drive to northbound Route 501 would turn left at the traffic light at Old Forest Road and then take the loop ramp onto northbound Route 501. This alternative adds substantially more traffic to Old Forest Road north of Lakeside Drive than most of the other alternatives do.

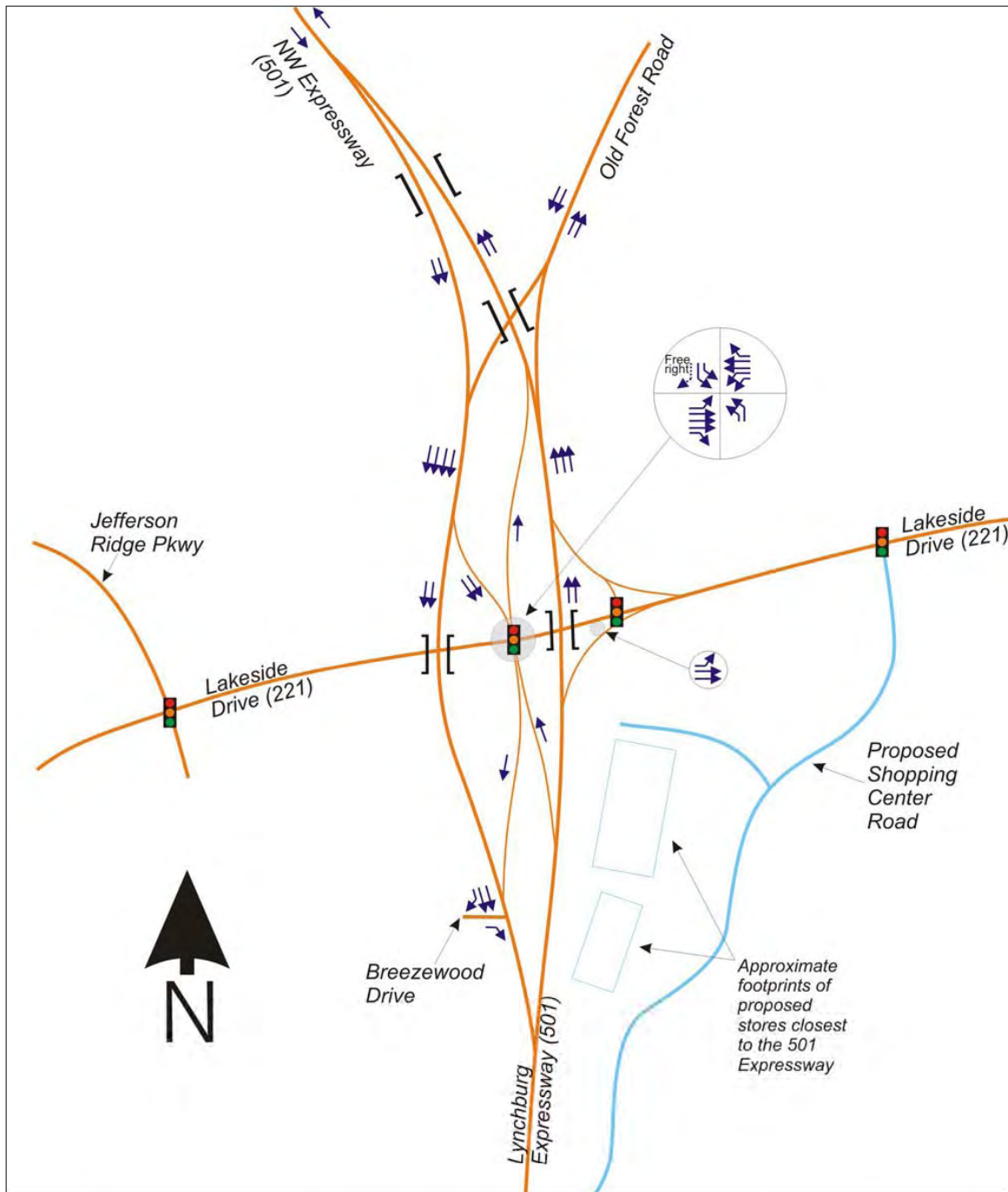
Alternative 10 (Exhibit 16) is the recommended concept from a 2002 study performed by VDOT. This concept provides loop ramps in the northwest and southeast quadrants of the interchange. The advantage that this concept provides is that a portion of the heaviest left turn traffic at the current Route 501/Lakeside Drive intersection (the eastbound to northbound traffic) would be accommodated on the southeast quadrant free-flowing loop ramp. The remaining eastbound to northbound left turns at the current intersection, which are destined to Old Forest Road, would turn left at the at-grade intersection on the east side of the freeway overpass.

The increased capacity requirements at other intersections in the study area can be provided for in a relatively straight-forward manner by constructing additional turn lanes at specific locations. Exhibits 17, 18, and 19 illustrate the improvements that would be needed to key intersections in the study area to provide for adequate traffic operations. Note that for the locations shown in the vicinity of Wyndale Drive (Exhibit 18), widening of Lakeside Drive east of Route 501 and improvements to intersections along Lakeside Drive are currently being studied by the Virginia Department of Transportation. Also note that Exhibits 17 through 19 also provide information on intersection levels of service – additional discussion of traffic operations at these intersections, as well as for the tested alternatives for the Lakeside Drive/Old Forest Road/Route 501 junction, is included in Section 4.



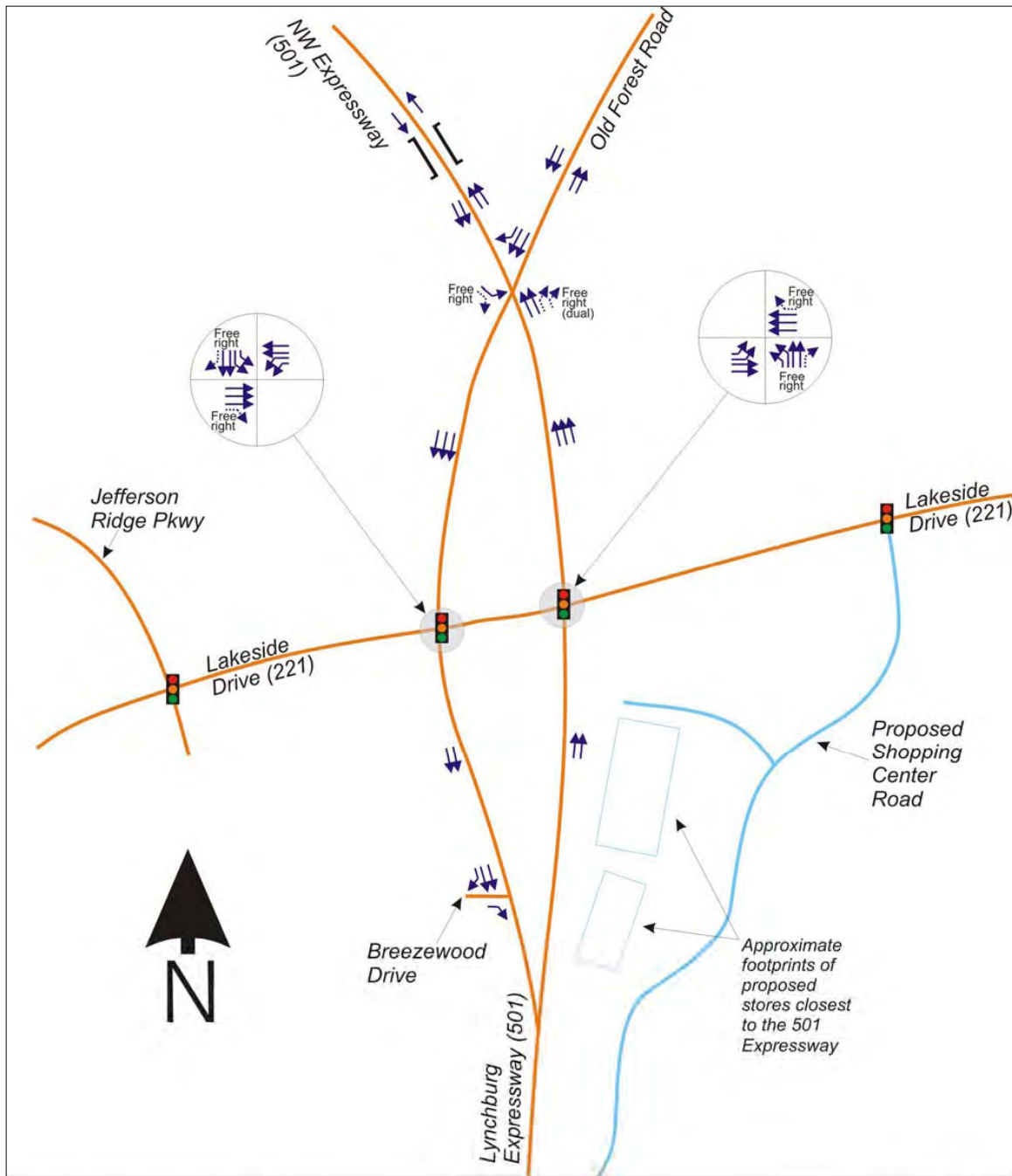






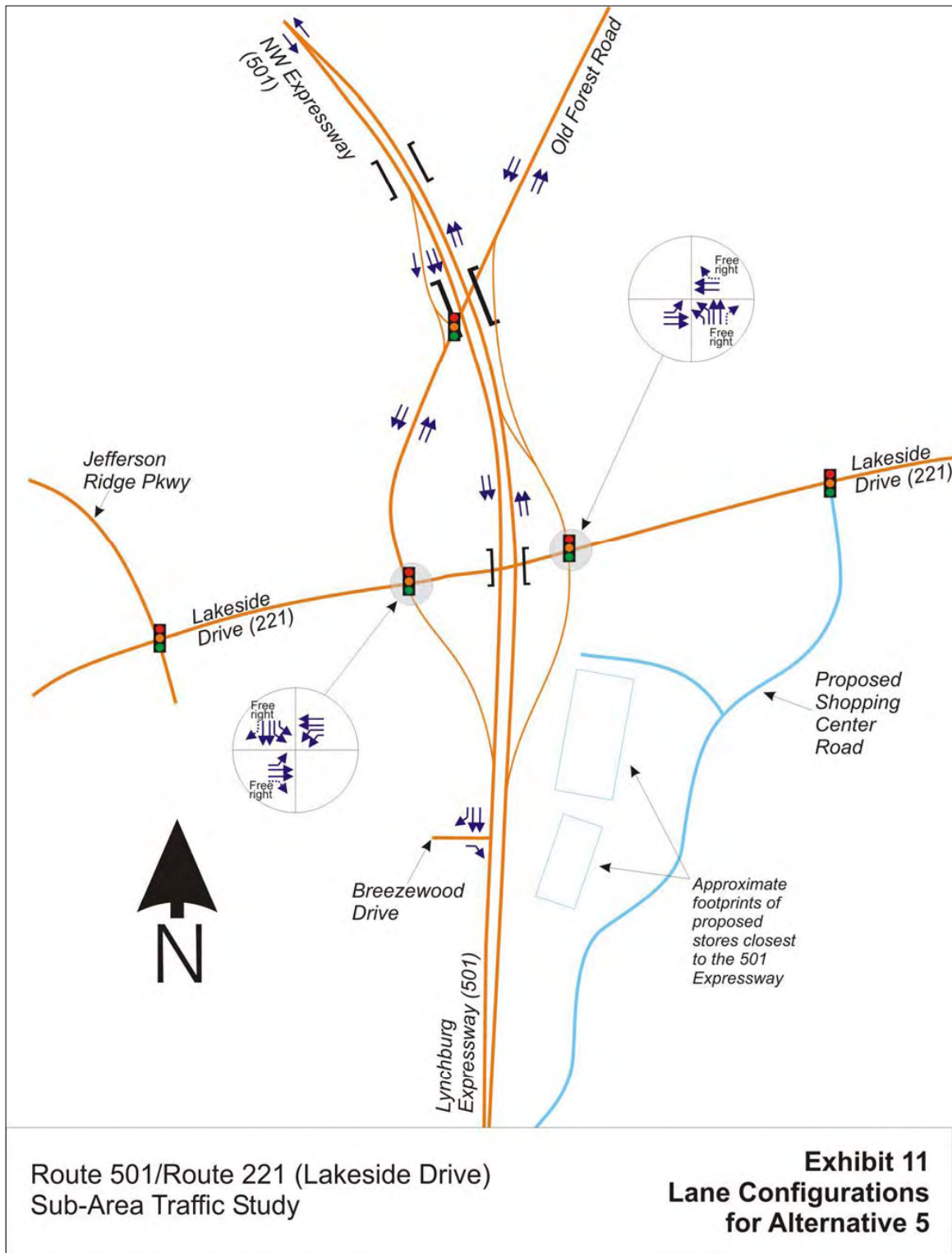
Route 501/Route 221 (Lakeside Drive)
Sub-Area Traffic Study

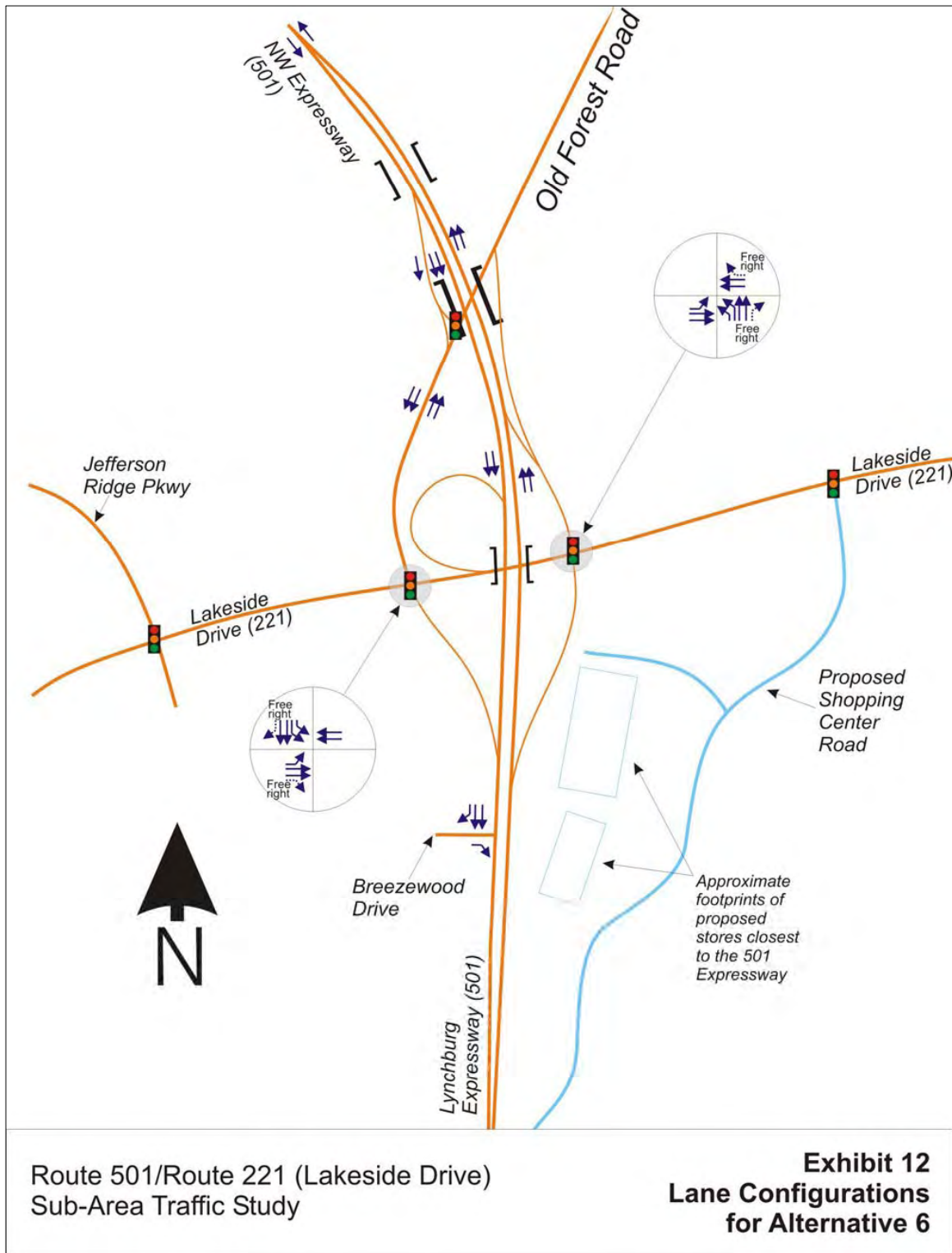
Exhibit 9
Lane Configurations
for Alternative 3

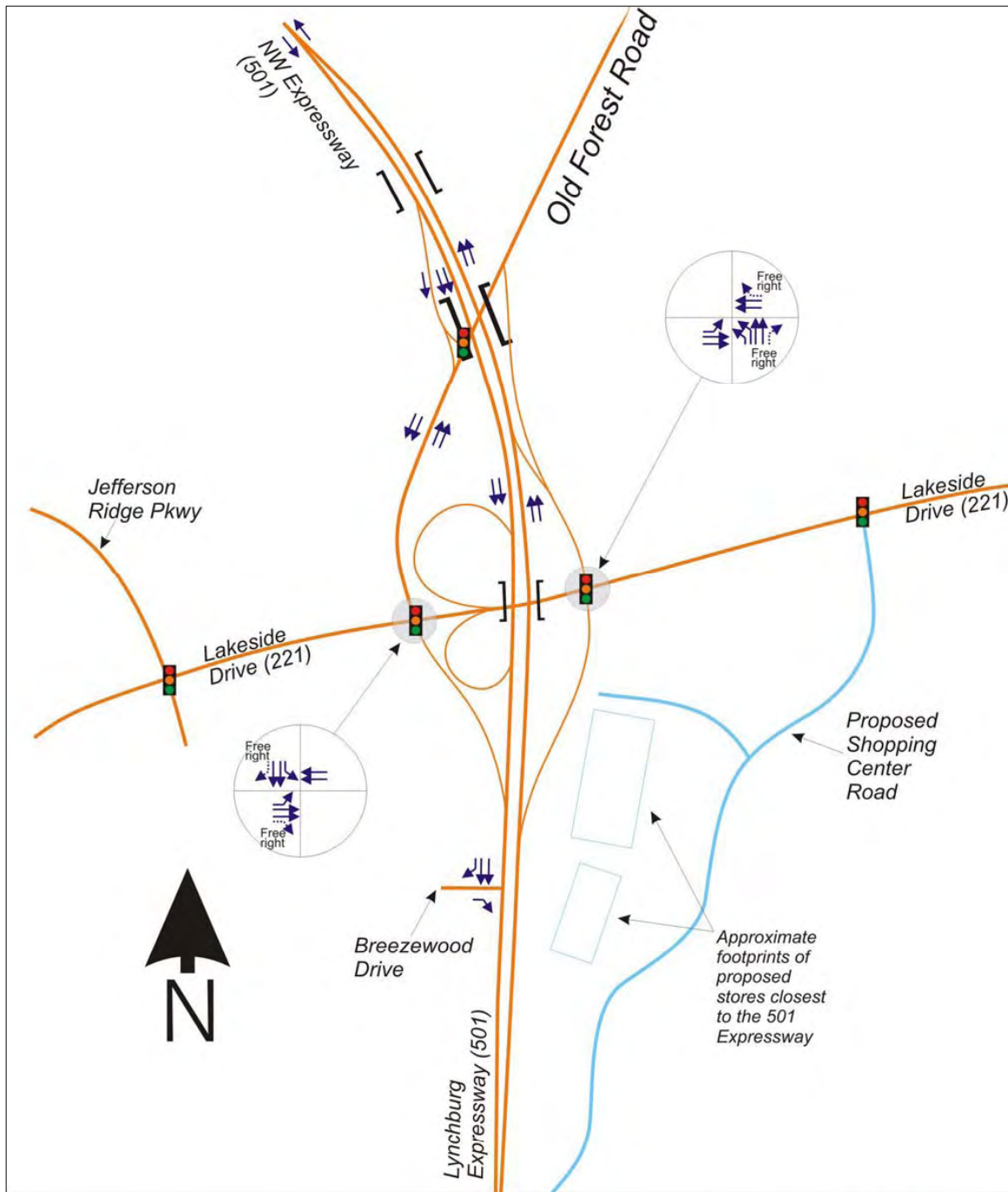


Route 501/Route 221 (Lakeside Drive)
Sub-Area Traffic Study

Exhibit 10
Lane Configurations
for Alternative 4

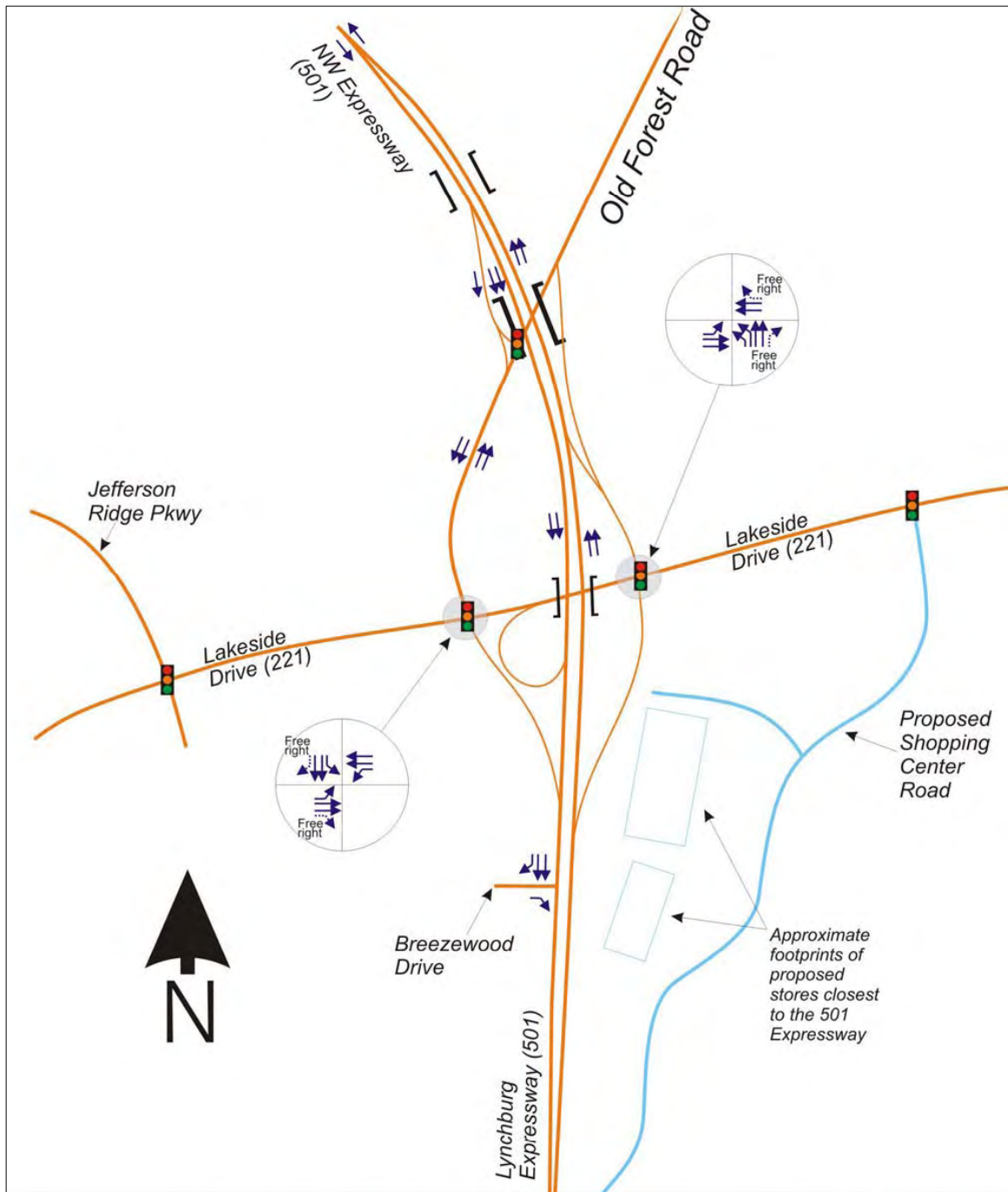






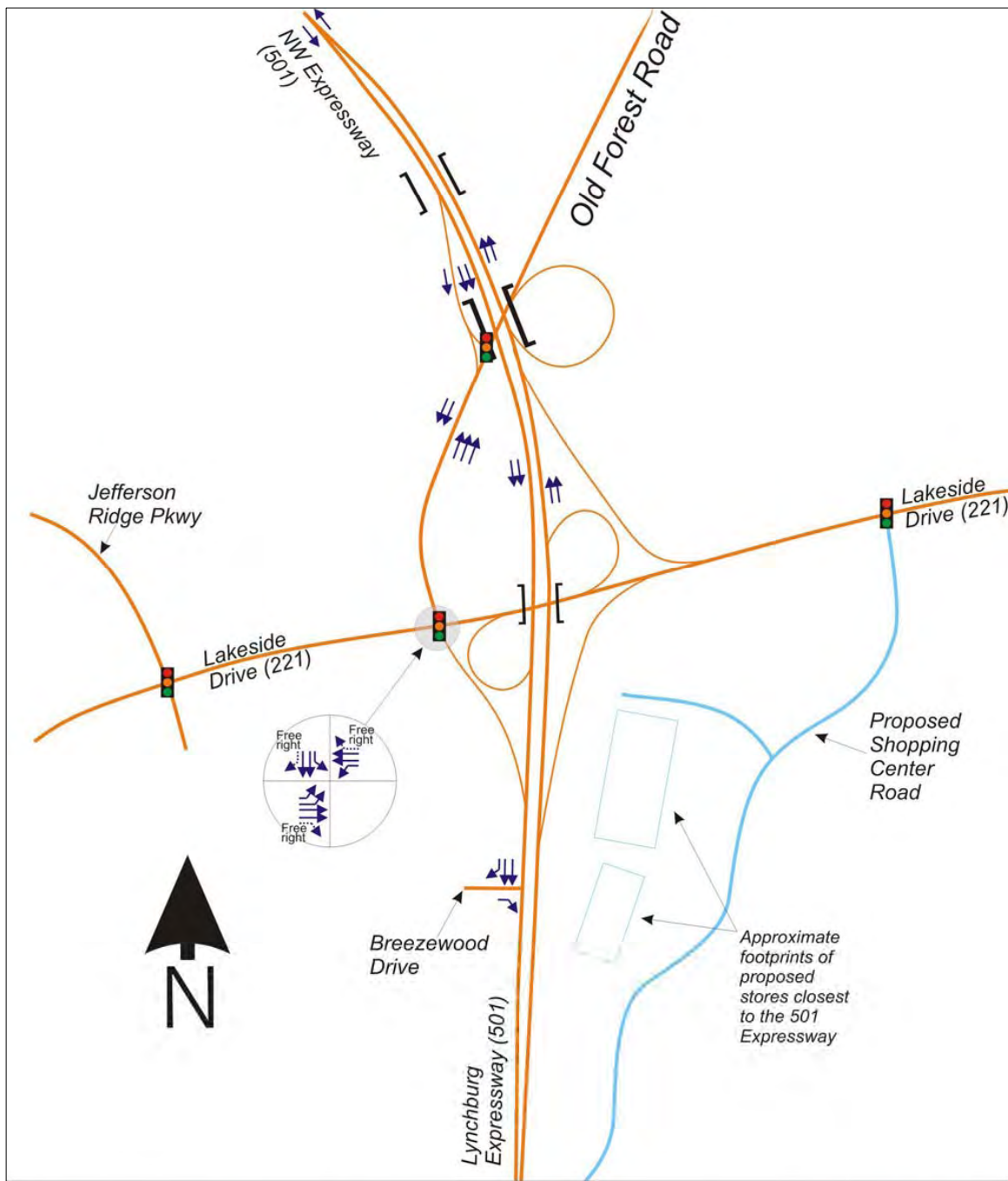
Route 501/Route 221 (Lakeside Drive)
Sub-Area Traffic Study

Exhibit 13
Lane Configurations
for Alternative 7



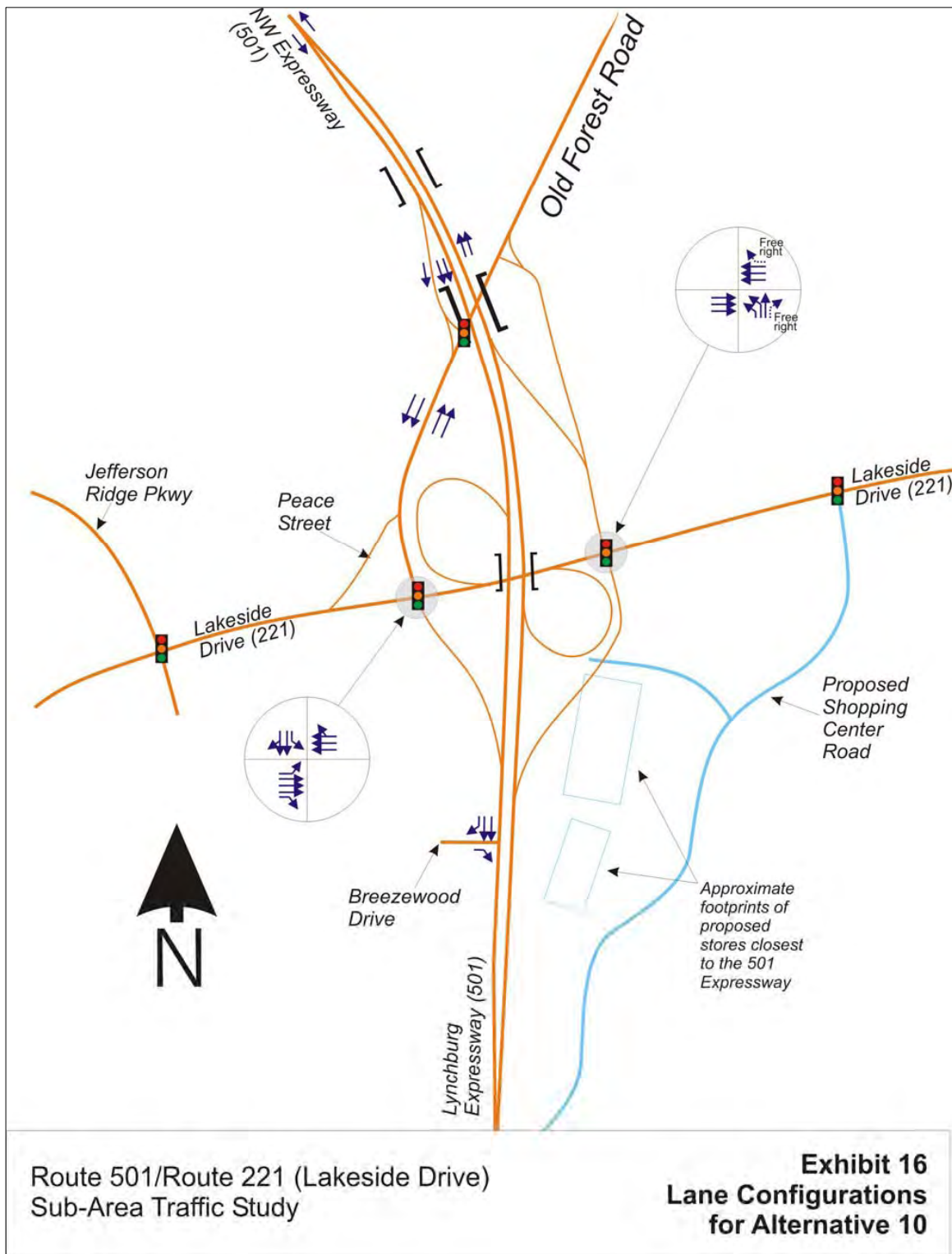
Route 501/Route 221 (Lakeside Drive)
Sub-Area Traffic Study

Exhibit 14
Lane Configurations
for Alternative 8

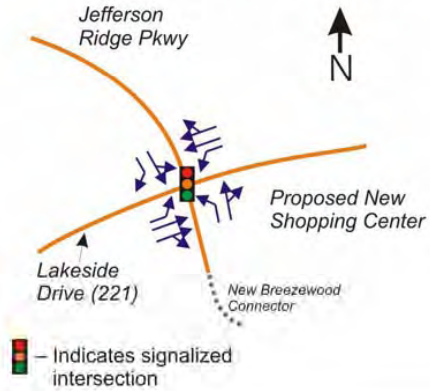


Route 501/Route 221 (Lakeside Drive)
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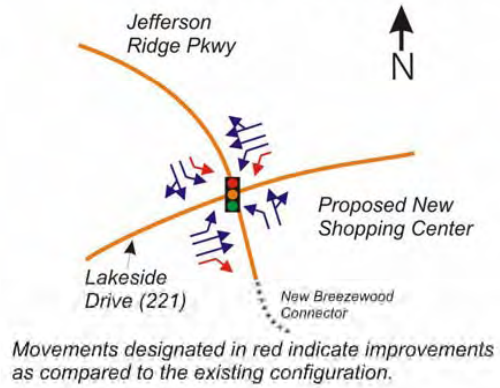
Exhibit 15
Lane Configurations
for Alternative 9



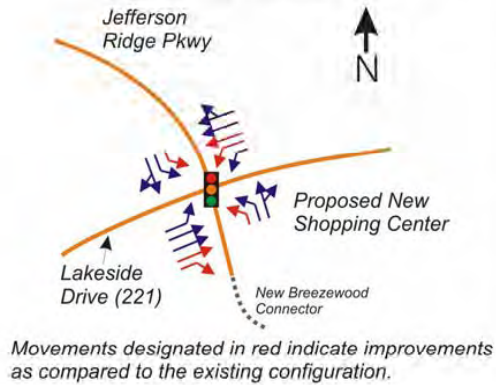
Existing Configuration



2010 Configuration



2030 Configuration



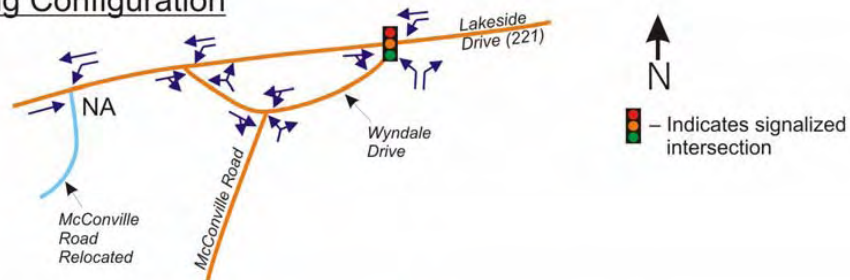
Lakeside Drive at Jefferson Ridge Parkway

	AM Peak	Mid-Day Peak	PM Peak
Existing (2005) levels of service	A	A	A
Year 2010 levels of service if no improvements are made	B	D	E
Year 2010 levels of service if turn lanes are added as shown in the diagram above	B	B	B
Year 2030 levels of service if no improvements are made	C	F	F
Year 2030 levels of service if turn lanes are added as shown in the diagram to the left	C	C	C

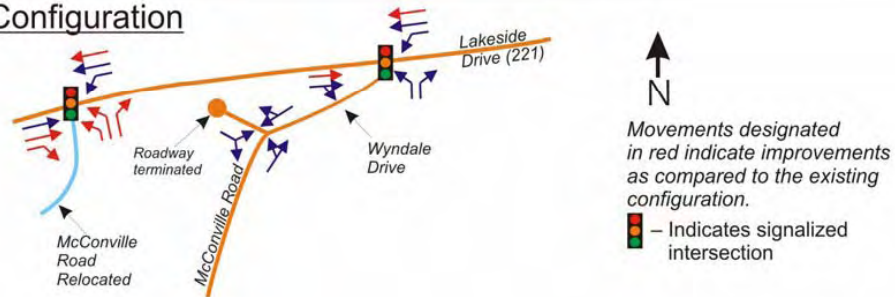
Route 501/Route 221 (Lakeside Drive)
Sub-Area Traffic Study

Exhibit 17
Lane Configurations for
Jeff. Ridge Pkwy/Lakeside Drive

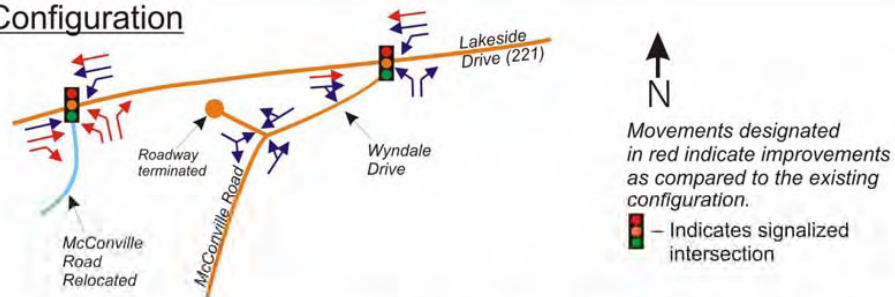
Existing Configuration



2010 Configuration



2030 Configuration



	Lakeside Drive at New Shopping Center			Lakeside Drive at Wyndale Drive West			Lakeside Drive at Wyndale Drive East			Wyndale Drive at McConville Road		
	AM Peak	Mid-Day Peak	PM Peak	AM Peak	Mid-Day Peak	PM Peak	AM Peak	Mid-Day Peak	PM Peak	AM Peak	Mid-Day Peak	PM Peak
Existing (2005) levels of service	NA	NA	NA	F*	F*	F*	A	A	A	A	A	A
Year 2010 levels of service if no improvements are made	NA	NA	NA	F*	F*	F*	C	D	E	A	A	A
Year 2010 levels of service if improvements as shown in the diagram above are implemented	A	B	B	**	**	**	A	A	A	A	A	A
Year 2030 levels of service if no improvements are made	NA	NA	NA	F*	F*	F*	C	D	E	A	A	B
Year 2030 levels of service if improvements as shown in the diagram above are implemented	C	C	B	**	**	**	A	A	A	A	A	B

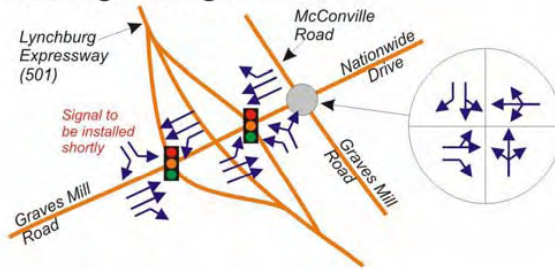
* – This level of service is for the relatively small amount of traffic exiting Wyndale Drive West. Because this is an unsignalized intersection, traffic on Lakeside Drive itself would not experience significant delays.

** – Intersection closed

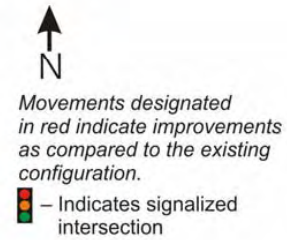
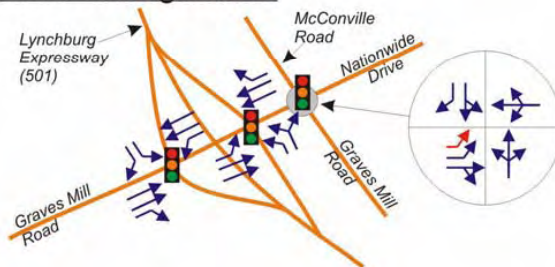
Route 501/Route 221 (Lakeside Drive)
Sub-Area Traffic Study

Exhibit 18
Lane Configurations for
Vicinity of Wyndale Drive

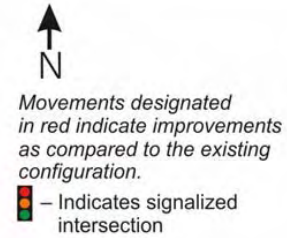
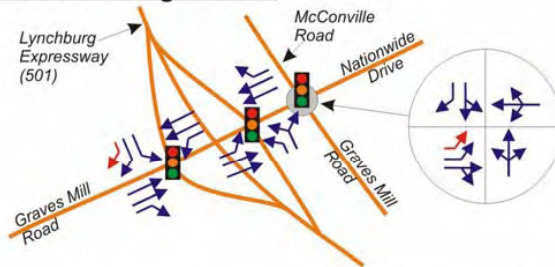
Existing Configuration



2010 Configuration



2030 Configuration



	Graves Mill Road at Route 501 SB Ramp			Graves Mill Road at Route 501 NB Ramp			Graves Mill Road at McConville Road		
	AM Peak	Mid-Day Peak	PM Peak	AM Peak	Mid-Day Peak	PM Peak	AM Peak	Mid-Day Peak	PM Peak
Existing (2005) levels of service	C	C	E	A	B	B	B	B	C
Year 2010 levels of service if no improvements are made	F	F	F	B	B	B	B**	F/D*	F/E*
Year 2010 levels of service if turn lanes are added as shown in the diagram above	A	C	C	B	B	B	A	A	B
Year 2030 levels of service if no improvements are made	F/C*	F/C*	F/D*	B	B	C	C/B*	F/D*	F/E*
Year 2030 levels of service if turn lanes are added as shown in the diagram to the left	A	B	C	B	B	C	A	B	C

* -- the first value is as an unsignalized intersection, the second value is as a signalized intersection.

** -- four-way stop

Route 501/Route 221 (Lakeside Drive)
Sub-Area Traffic Study

Exhibit 19
Lane Configurations for
Vicinity of Graves Mill Road

4. Comparison of Alternatives

All of the improvements (for both the alternatives at Lakeside Drive/Old Forest/Route 501 and for all other study area intersections) were developed with a goal of providing sufficient lane capacity to allow traffic operations at level of service C or better in both 2010 and 2030. As noted in the discussion below, however, physical constraints and other factors precluded level of service C at all locations and all time periods. A summary of traffic operations for each alternative is included in Exhibit 20. The traffic operations reported in Exhibit 20 reflect the lane configurations shown in Exhibits 6 through 16.

Exhibit 20
Comparison of Levels of Service at 501 Expressway/
Lakeside Drive/Old Forest Road Junction

Alternative – Year	Route 501 at Lakeside Drive		Old Forest Road at Northwest 501 Expressway [1]
	West Intersection [1] [2]	East Intersection [1] [2]	
Existing – 2005	D/D/E	NA	B/B/C
No-Build – 2010	E/F/F	NA	C/D/F
No-Build – 2030	F/F/F	NA	D/F/F
1 – 2010	C/D/E	NA	A/A/C
1 – 2030	D/E/F	NA	A/B/C
2 -- 2010	C/D/E	NA	A/A/C
2 -- 2030	D/E/F	NA	A/B/C
3 – 2010	B/C/B	NA	NA
3 – 2030	B/B/C	NA	NA
4 – 2010	B/B/C	B/B/B	A/A/B
4 – 2030	B/B/D	B/B/D	A/B/C
5 -- 2010	B/C/C	A/B/B	A/A/A
5 -- 2030	B/C/D	B/B/C	A/A/A
6 -- 2010	B/B/C	A/B/B	A/A/A
6 -- 2030	B/C/D	B/C/D	A/A/A
7 -- 2010	A/B/C	B/B/B	A/A/A
7 -- 2030	B/B/D	B/B/C	A/A/A
8 -- 2010	B/B/C	B/A/B	A/A/A
8 -- 2030	B/B/D	A/B/C	A/A/A
9 -- 2010	B/B/C	NA	A/A/A
9 -- 2030	B/C/D	NA	A/A/A
10 -- 2010	B/B/C	A/A/A	A/A/A
10 -- 2030	B/C/C	A/B/B	A/A/A

Notes:

[1] – Level of service is shown as A/M/D where A is a.m. peak, M is mid-day peak, P is p.m. peak.

[2] – This describes the general location of signalized intersections associated with each improvement. The west intersection is located west of the mainline 501 Expressway, while the east is on the opposite side. Several alternatives only have an at-grade intersection on one side.

Junction of Route 501 Expressway, Lakeside Drive, and Old Forest Road

For the No-Build Alternative, the intersections of Route 501 and Lakeside Drive, as well as the intersection of Old Forest Road and the 501 Northwest Expressway, are both anticipated to operate at deficient levels of service for almost all peak periods in both 2010 and 2030 (the only exception is the Old Forest Road/Route 501 Northwest Expressway intersection which would operate at level of service C in 2010 in the a.m. peak).

Alternative 1, which adds turn lanes to the Route 501/Lakeside Drive and Old Forest Road/Route 501 Northwest Expressway intersections, provides some benefits at each of these locations. With the exception of the 2030 p.m. peak, this alternative provides improvements of one or more level of service grades at Route 501/Lakeside Drive. For the 2030 p.m. peak, the level of service F experienced with the No-Build would continue to an F with this alternative. Levels of service at this intersection would remain at deficient grades of D or worse with the exception of the a.m. peak in 2010 which would experience level of service C. The improvements at the Old Forest Road/Route 501 Northwest Expressway intersection with this alternative would improve levels of service to C or better for all time periods in both 2010 and 2030.

In terms of levels of service, Alternative 2 would provide identical benefits as Alternative 1. Improvements gained at Route 501/Lakeside Drive from the provision of free right turns would be offset by the increased traffic going through the intersection from Peace Street (note that this alternative recommends removing Peace Street as a shortcut). This alternative provides identical improvements as Alternative 1 at Old Forest Road/Route 501 Northwest Expressway; resulting in similar improvements in intersection levels of service.

Alternative 3 would provide adequate levels of service for all peak periods in both 2010 and 2030. A critical movement at this intersection (termed the “center intersection” for purposes of this discussion) is the very heavy southbound right turn, particularly in the p.m. peak. Allowing for a free-right and/or a double-right turn at this location would continue to allow for adequate operations at this intersection. Note that a free-right will require that westbound Lakeside Drive carry three lanes to, and perhaps west of, the Honda dealership which is located in the northwest quadrant of the existing intersection. One additional advantage of having the intersection in the middle of the roadways is that the wider cross-section for Lakeside Drive (6 lanes or more) needed to carry traffic is more confined to the interchange area than the other alternatives.

It is important to note that Alternative 3 would not allow for southbound traffic on the 501 Northwest Expressway to turn left onto Old Forest Road. Making this movement under these alternatives would require turning left at the new center intersection and then turning left back onto the ramp towards Old Forest Road and the Northwest Expressway. Note that this movement is very small because most motorists wishing to make this movement use Wiggington Road which is the next exit to the north on the Expressway. Providing for this movement could be engineered but both the cost and right-of-way

requirements for this connection would be high as compared to the relatively small benefit.

Alternative 4, which creates a split-intersection at-grade for connections between the Route 501 Expressway and Lakeside Drive, is anticipated to provide level of service C or better during all peak periods in 2010, and for the a.m. and mid-day peak periods in 2030. It would provide level of service D in 2030 during the p.m. peak (the highest traffic hour of the day). For the intersection at Old Forest Road/Route 501 Northwest Expressway, which is proposed to be improved but remain as an at-grade intersection, levels of service of C or better can be achieved for all time periods in both 2010 and 2030.

The levels of service for Alternatives 5 through 9 are relatively consistent, with trade-offs between the alternatives in terms of constructing loop ramps versus providing additional travel lanes at intersections. Alternatives 5 through 9 provide adequate levels of service for all peak periods in both 2010 and for the a.m. peak in 2030. The level of service at the west side intersection for each of these alternatives (the one at the same location as the current intersection of Lakeside Drive and Route 501) in the p.m. peak hour in 2030 would be a D. Adding an additional through lane in each direction on Lakeside Drive through the interchange area would result in adequate service levels for all of these alternatives. The widening of Lakeside Drive to 6 lanes through the interchange area is not a recommendation at this time, however, due to concerns about the right-of-way impacts of such action, particularly west of the existing intersection.

As with Alternatives 3 and 4, a critical movement that needs to be accommodated for Alternatives 5 through 9 is the southbound right turns traveling onto westbound Lakeside Drive. This is shown in all alternatives as a free right movement which requires that westbound Lakeside Drive in the vicinity of the Honda dealership be three lanes. Note that all of the alternatives developed for this study seek to accommodate this movement without the use of Peace Street which currently serves as a shortcut. The demand for this movement is anticipated to exceed 9,000 vehicles per day by 2030; accommodating this demand on Peace Street is not recommended as a long-term strategy.

As indicated previously, Alternative 10 is the concept developed in 2002 by the consulting firm of Parsons Brinkerhoff under contract to VDOT. This configuration would provide somewhat better levels of service than Alternatives 5 through 9 (levels of service A and B versus levels of service C and D). It is important to note that this alternative does incorporate the widening of Lakeside Drive to 6 lanes, thereby providing additional through-capacity at both of the at-grade intersections contained in this concept. Note also that Peace Street is utilized by close to 900 vehicles per hour in the 2030 p.m. peak under this alternative. Shifting this traffic to the west-side intersection would require the construction of a free-right turn lane (as for the other alternatives) in order to continue providing level of service C operations.

Other Study Area Intersections

The Lakeside Drive and Jefferson Ridge Parkway intersection currently operates at level of service A during the a.m. and mid-day peak periods, and at B during the p.m. peak. Additional traffic loads from both shopping centers (it is anticipated that this intersection will be the primary entry into the Site 3 Shopping Center) would result in levels of service D and E in the mid-day and p.m. peak periods, respectively, in 2010. In 2030, this level of service would worsen to an F for the same peak periods. For 2010, additional turn lanes (southbound and westbound lefts, and eastbound right) would result in level of service C for all time periods. Additional through capacity on Lakeside Drive (one additional lane in each direction) would be necessary to provide adequate service levels in 2030.

Similar levels of improvement would be required for the intersection of Wyndale Drive East and Lakeside Drive, as well as the new entrance to the proposed Site 1 Shopping Center. When it opens, the exit from the shopping center should provide for a westbound left turn lane (Lakeside Drive has a center bi-directional turn lane at this location), an eastbound right turn lane, as well as two left turn lanes and one right turn lane on the northbound approach coming out of the shopping center on McConville Road Relocated. One additional through lane in each direction would be necessary on Lakeside Drive by 2010 as well in order to provide sufficient through-lane capacity at this intersection to allow for operations at level of service C or better.

The existing intersection at Lakeside Drive and Wyndale Drive West operates at level of service F under existing conditions and is deficient in terms of geometrics. The level of service is based on the delays that traffic exiting Wyndale Drive onto Lakeside Drive experience from opposing traffic volumes on Lakeside Drive. The volume of traffic actually making this movement is very small, but additional traffic through this area will further worsen the operations at this intersection, as will any widening of Lakeside Drive. This intersection is also deficient in terms of geometrics, creating potential safety concerns. This study recommends that the Wyndale Drive West/Lakeside Drive intersection be closed. With this recommendation, traffic would divert to the signalized Wyndale Drive East/Lakeside Drive intersection and, as shown in Exhibit 20, McConville Road could be re-configured to flow directly into the eastern portion of Wyndale Drive. The western portion of Wyndale Drive would then form a T-intersection with McConville Road. Note that the closure of this intersection is also being considered as part of the current VDOT study of Lakeside Drive.

The existing four-way stop sign at Graves Mill Road and McConville Road will not be able to adequately accommodate traffic even to the year 2010, and a traffic signal would need to be installed at this location. It is anticipated that a traffic signal would also be needed at the intersection of Graves Mill Road and the Route 501 southbound ramp (a signal is already installed at the intersection with the northbound ramp). By 2030, the southbound ramp intersection is also anticipated to require an additional southbound right turn lane. At the Graves Mill Road/McConville Road intersection, an additional

eastbound left turn lane would be required at this signalized intersection to provide for adequate levels of service for both 2010 and 2030 conditions.

5. Other Study Area Transportation Considerations

Direct Shopping Center Access from the Route 501 Expressway

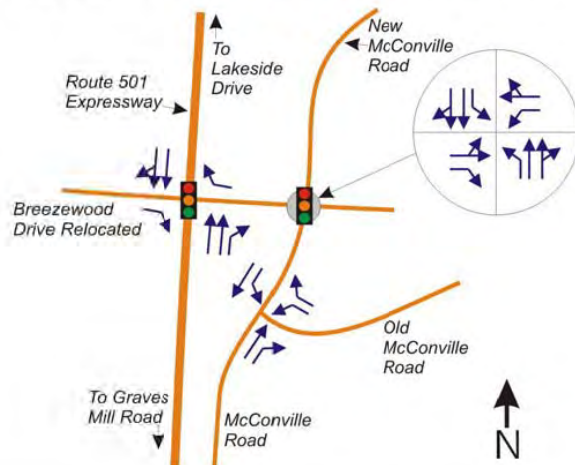
This study also considered the potential for direct access to the Site 1 and Site 2 shopping centers from the Route 501 Expressway. This improvement would involve the construction of an access point approximately 1,000 feet south of the existing Breezewood Drive intersection. Two concepts were tested for this direct access. The first would be a full 4-leg intersection allowing all movements and incorporating a traffic signal. The Breezewood Drive intersection, shifted south from its current location, would form the west leg of this new intersection. The second concept would allow only right-in and right-out access from the northbound lanes of the Route 501 Expressway. This concept would not require a traffic signal, but would require the construction of a northbound turn lane/deceleration lane as well as an acceleration lane for the westbound right turning traffic coming from the shopping areas. These concepts are illustrated in Exhibit 21.

Both concepts provide benefits, to different extents, of improved access to the shopping areas and both will also divert traffic from the Route 501 Expressway interchange at Graves Mill Road and the Graves Mill Road/McConville Road intersection. At the juncture of the Route 501 Expressway and Lakeside Drive, the effect of the direct shopping center access point will be to shift traffic within the intersection/interchange rather than divert it entirely from the juncture. For example, a portion of the southbound traffic on Old Forest Road going to the shopping center would travel straight through the Lakeside Drive intersection to get to the new access point rather than turn left to get to the shopping center via Lakeside Drive.

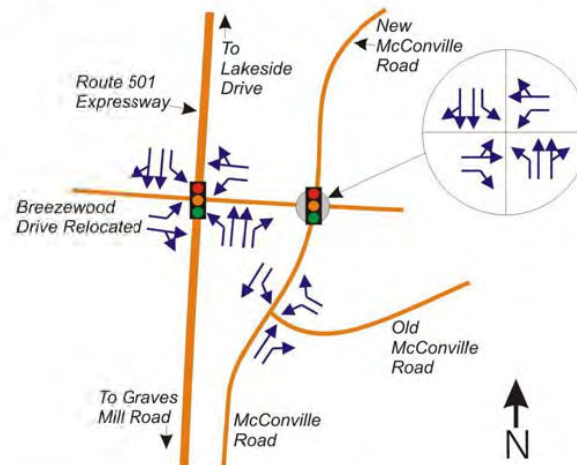
At the Route 501 Expressway/Graves Mill Road interchange, the new direct shopping center access point would remove traffic from both the northbound ramp intersection and the intersection of Graves Mill Road and McConville Road. The diversion would not affect the turn lane requirements at the northbound ramp terminus, but would eliminate the need for a second eastbound left turn lane at the Graves Mill Road/McConville Road intersection in both 2010 and 2030. This benefit accrues whether the new access point allows all movements or only provides for right-in-right out from the northbound Expressway lanes.

Traffic benefits at the Route 501 Expressway/Lakeside Drive junction point from the new access point would be relatively minor, particularly for the right-in/right-out concept. As described above, the new access point does not divert traffic entirely from this intersection; it shifts it from one type of turn movement to another.

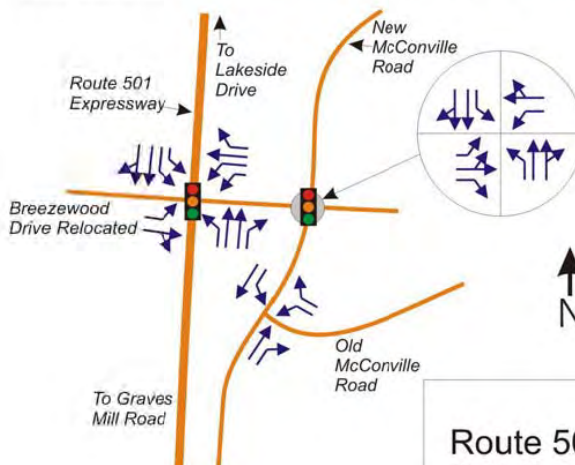
Right-In/Right-Out Configuration



2010 Full Intersection Configuration



2010 Full Intersection Configuration



	Route 501 Expwy at Shopping Cntr Access			New McConville Road at Shopping Cntr Access			New McConville Road at Old McConville Road		
	AM Peak	Mid-Day Peak	PM Peak	AM Peak	Mid-Day Peak	PM Peak	AM Peak	Mid-Day Peak	PM Peak
Year 2010 levels of service for right-in/right-out access; improvements as shown	*	*	*	A	A	A	B	C	C
Year 2030 levels of service for right-in/right-out access; improvements as shown	*	*	*	A	A	A	C	C	F
Year 2010 levels of service for all-movements access; improvements as shown	A	C	C	A	A	A	B	C	D
Year 2030 levels of service for all-movements access; improvements as shown	B	C	E	A	C	C	C	C	F

* -- right turn traffic merges onto Route 501 Expressway, intersection level of service not applicable.

Route 501/Route 221 (Lakeside Drive)
Sub-Area Traffic Study

Exhibit 21
Lane Configurations for
Potential New Access Point

An overall summary of the pros and cons of the new shopping center access point on the Route 501 Expressway is included as Exhibit 22, but one major negative impact bears additional elaboration. As the level of service E at the intersection of the Route 501 Expressway and the proposed access road in the year 2030 indicates, the volume of traffic on the Expressway is anticipated to be at a level where any traffic signal would create unacceptable levels of service. This is because traffic signals, by their very nature, reduce the capacity of a roadway by the percentage of time that a traffic light is red (as well as lost time for vehicle start-up and other factors). The volumes on the Expressway will be much closer to its four-lane capacity by 2030 than they are today, and the significant capacity reductions from a traffic signal would result in substantial congestion and delays. The benefits of the substantial long-term investments to provide for grade separation less than half a mile to the north at the Lakeside Drive intersection in order to reduce overall delays would be negated by the construction of new signalized intersection at this location.

Exhibit 22
**Summary of Pros and Cons for Potential New Shopping
Center Access Point on Route 501 Expressway**

Access Option	Pros	Cons
Full intersection at Route 501 Expressway	<ul style="list-style-type: none"> ➤ Provides highest degree of direct access for the shopping center – serving the 20-40 percent of shopping trips that come from the south or southwest, going both to and from the shopping center. ➤ Diverts sufficient traffic from the McConville Road/Graves Mill Road intersection to alleviate the need for an additional eastbound left turn lane (both options provide this benefit). ➤ Diverts traffic from McConville Road, north of Graves Mill Road, in both directions. ➤ Relieves some of the northbound left turns at the shopping center/ Lakeside Drive intersection (New McConville Road at Lakeside Drive) (both options provide this benefit). 	<ul style="list-style-type: none"> ➤ A new access point that requires traffic on the Route 501 Expressway to stop at a traffic signal creates potential safety problems for traffic that has the expectation of freeway/limited access travel conditions. This is exacerbated by the fact that the new intersection would so close to the grade-separated interchange at Graves Mill Road) ➤ By the year 2030, it is anticipated that this intersection would operate at level of service E; requiring additional travel lanes on the Route 501 Expressway. Effectively, this new access point would accelerate the date that the Expressway would need to be six lanes (at least between Graves Mill Road and Lakeside Drive).
Right-in/Right-out Option at Route 501 Expressway	<ul style="list-style-type: none"> ➤ Provides direct access to the shopping center for the 20-40 percent of shopping trips that come from the south or southwest. Return trips would make use of McConville Road and Graves Mill Road ➤ Diverts sufficient traffic from the McConville Road/Graves Mill Road intersection to alleviate the need for an additional eastbound left turn lane (both options provide this benefit). 	<ul style="list-style-type: none"> ➤ Acceleration and deceleration lanes would need to be constructed on the Route 501 for the northbound lanes. ➤ There is the potential for back-ups onto the Route 501 Expressway during particularly heavy retail times (such as the Christmas season).

Exhibit 22
**Summary of Pros and Cons for Potential New Shopping
Center Access Point on Route 501 Expressway**

Access Option	Pros	Cons
	<ul style="list-style-type: none"> ➤ Diverts traffic from McConville Road, north of Graves Mill Road, in the northbound direction only. ➤ Relieves some of the northbound left turns at the shopping center/ Lakeside Drive intersection (New McConville Road at Lakeside Drive) (both options provide this benefit). 	

Improvements to McConville Road

The proposed New McConville Road that would be constructed with the Site 1 Shopping Center will provide an alternative for traffic that currently uses the northern half of existing McConville Road (between the sharp bend 0.9 miles north of Graves Mill Road and Wyndale Drive). This provides a substantial benefit as much of this section of road has substandard geometrics, both vertical and horizontal. The southern half of McConville Road, from Graves Mill Road to 0.9 miles north of Graves Mill Road, is also two lanes, but has generally better geometrics than the northern half. As indicated in previous discussions (and shown in Exhibit 21), double left-turn lanes would be required in both 2010 and 2030 for eastbound traffic at the McConville Road/Graves Mill Road intersection if the new access point on the Route 501 Expressway was not constructed. This would require two northbound lanes to accept this traffic, and these two northbound lanes would likely extend to, and perhaps beyond, some of the commercial entrances on the east side of McConville Road. Over the long-term, it would be desirable to reconstruct this southern half of McConville Road to bring the road up to current standards and to provide capacity that matches New McConville Road. While a new access point on the Route 501 Expressway would reduce traffic on this southern half of McConville Road (the right-in/right-out option would reduce only the northbound traffic), reconstruction would still be beneficial, and consideration is still recommended for reconstructing the roadway as a four-lane facility. The estimated cost for reconstructing this 0.9 section of McConville Road as an urban two-lane roadway is \$3.26 million (including right-of-way, engineering, and contingencies). Reconstruction as an urban four-lane roadway is estimated to cost \$6.21 million.

6. Estimated Costs

Planning-level cost estimates were developed for the intersection improvements in the study area as well as each of the alternative improvements described in the previous section. The cost estimates are based on statewide average unit costs that have been developed by VDOT for planning studies. It is important to note that these estimates are subject to refinement based on detailed engineering, but they provide an excellent means for comparing alternatives at the planning stages. Exhibits 23 and 24 summarize the

estimated costs for study area intersection improvements and for the tested alternatives, respectively.

Exhibit 23

Summary of Estimated Costs for Interchange Alternatives (millions)

Alternative	Lane-Miles of Improvement	Roadway Cost	Structure Cost	Right-of-Way Cost	Total Cost
1	0.75	\$1.96	\$0	\$0.77	\$2.73
2	5.30	\$9.26	\$0	\$4.04	\$13.30
3	9.75	\$13.75	\$4.70	\$8.68	\$27.12
4	7.36	\$10.84	\$0	\$5.21	\$16.05
5	10.08	\$14.04	\$5.98	\$9.80	\$29.83
6	10.70	\$14.63	\$5.98	\$10.10	\$30.71
7	10.68	\$14.65	\$5.98	\$10.11	\$30.74
8	10.40	\$13.86	\$5.98	\$9.71	\$29.55
9	10.08	\$14.64	\$7.19	\$10.81	\$32.63
10	10.56	\$14.75	\$6.46	\$10.40	\$31.61

Note: These costs are planning-level and subject to change based on engineering and environmental considerations. Costs include 20 percent for engineering and contingencies. Costs are in 2005 dollars.

Exhibit 24

Summary of Estimated Costs for Other Intersection Improvements (in millions)

Location	2010 Improvements		2030 Improvements	
	Description	Estimated Cost	Description	Estimated Cost
Lakeside Drive at Jefferson Ridge Parkway	Add two left turn lanes (southbound and westbound) and one right turn lane (eastbound)	\$0.900	Additional through lanes in both the eastbound and westbound directions	\$1.855
Lakeside Drive at new shopping center entrance.	Extend the widening of Lakeside Drive by approximately 1200 feet from the interchange improvements; construct right turn lane. Improvements within the shopping center are not included in this estimate.	\$2.064	No additional improvements recommended.	--
Lakeside Drive at Wyndale Drive West	Close intersection.	--	No additional improvements recommended.	--

Exhibit 24

Summary of Estimated Costs for Other Intersection Improvements (in millions)

Location	2010 Improvements		2030 Improvements	
	Description	Estimated Cost	Description	Estimated Cost
Lakeside Drive at Wyndale Drive East	The widening of Lakeside Drive is part of an ongoing study by VDOT. Addressing the capacity needs of this intersection will be addressed by that project.	--	The widening of Lakeside Drive is part of an ongoing study by VDOT. Addressing the capacity needs of this intersection will be addressed by that project.	--
Wyndale Drive at McConville Road	No improvements recommended.	--	Reconfigure to make the McConville Road northbound to Wyndale Drive eastbound movement the major, continuous movement. McConville Road from the west would tee into this intersection at a stop sign.	\$0.450
Graves Mill Road at McConville Road	Install signal; add eastbound left turn lane.	\$0.350	No additional improvements recommended.	--
Graves Mill Road at Route 501 northbound ramp	No improvements recommended.	--	No improvements recommended	--
Graves Mill Road at Route 501 southbound ramp	Install signal	\$0.200	Add additional southbound right turn lane	\$0.100
Subtotals		\$3.514		\$1.955
			Overall Total	\$5.469

Note: These costs are planning-level and subject to change based on engineering and environmental considerations. Costs include 20 percent for engineering and contingencies. Costs are in 2005 dollars.

While not tested as a separate alternative, the option of taking Alternative 3 and reducing costs by providing an at-grade intersection rather than an interchange at the junction of Old Forest Road and the Route 501 Northwest Expressway was assessed. This option combines Alternative 3 with the at-grade option of Alternative 4 at Old Forest Road/Route 501 Northwest Expressway. Traffic operations at this intersection under Alternative 3 would be identical to those under Alternative 4 – level of service C or better could be achieved for all time periods in both 2010 and 2030. It is anticipated that this modification to Alternative 3 would reduce the estimated costs from \$27.12 million to \$21.45 million while still providing the same levels of service. Note that, while levels of service would be adequate under both Alternative 3 and this Alternative 3 option, travel time through the area would be increased based on the shift from a free-flow interchange to a stop-light-controlled at-grade intersection.

One additional consideration with respect to an at-grade intersection at Old Forest Road and the Route 501 Northwest Expressway are the potential engineering constraints of

topography and the railroad tracks. While at this preliminary planning level, it is anticipated that these constraints could be overcome relatively easily, more detailed engineering analysis would be necessary to fully verify this conclusion. The relatively sharp drop in elevation on the existing Route 501 Northwest Expressway just south of the railroad bridge does suggest that bridging the Expressway over Old Forest Road would be a preferred option if the funding constraints could be addressed.

7. Study Conclusions

This study has quantified travel demands in the vicinity of the Route 501 and Lakeside Drive on the west side of the City of Lynchburg and assessed the costs and effectiveness of a number of alternatives to accommodate these demands. The combination of heavy existing travel demands, expected continued growth in traffic, and the travel demands associated with new retail land uses in the area are resulting in the need for relatively high levels of investment in transportation capacity in this area. This study identified some alternatives to previously developed concepts that are both lower cost and have smaller demands in terms of rights-of-way.

While each of the alternatives studied imposes costs as well as providing benefits, the study's authors believe that, on balance, Alternative 4 provides a high level of benefit at a relatively low cost. As travel demands increase, this alternative also provides the option of transitioning to the grade-separated option described as Alternative 3. Drawbacks to this alternative include impacts on existing land uses, both in terms of needing to acquire right-of-way as well as impacts on local circulation and accessibility to existing commercial properties. While these impacts would be keenly felt, it is believed that, over the long term, the character of development in this area will continue to shift. This new development will ultimately benefit from improved accessibility to this important area of the City.